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LABORATORY

PREPARED FOR
NATIONAL ENVIRONMENTAL RESEARCH CENTER

JUNE 1975

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U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY

WORKING PAPER SERIES

REPORT

ON

REND LAKE

FRANKLIN AND JEFFERSON COUNTIES

ILLINOIS

EPA REGION V

WORKING PAPER No. 313

CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY - CORVALLIS, OREGON

and

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REPORT
ON
REND LAKE
FRANKLIN AND JEFFERSON COUNTIES
ILLINOIS

EPA REGION V

WORKING PAPER No. 313

WITH THE COOPERATION OF THE

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

AND THE

ILLINOIS NATIONAL GUARD

JUNE, 1975

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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

17. KEY WORDS AND DOCUMENT ANALYSIS

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to fresh water lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Illinois Environmental Protection Agency for professional involvement and to the Illinois National Guard for conducting the tributary sampling phase of the Survey.

Dr. Richard H. Briceland, Director of the Illinois Environmental Protection Agency; and Ronald M. Barganz, State Survey Coordinator, and John J. Forneris, Manager of Region III, Field Operations Section of the Division of Water Pollution Control, provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

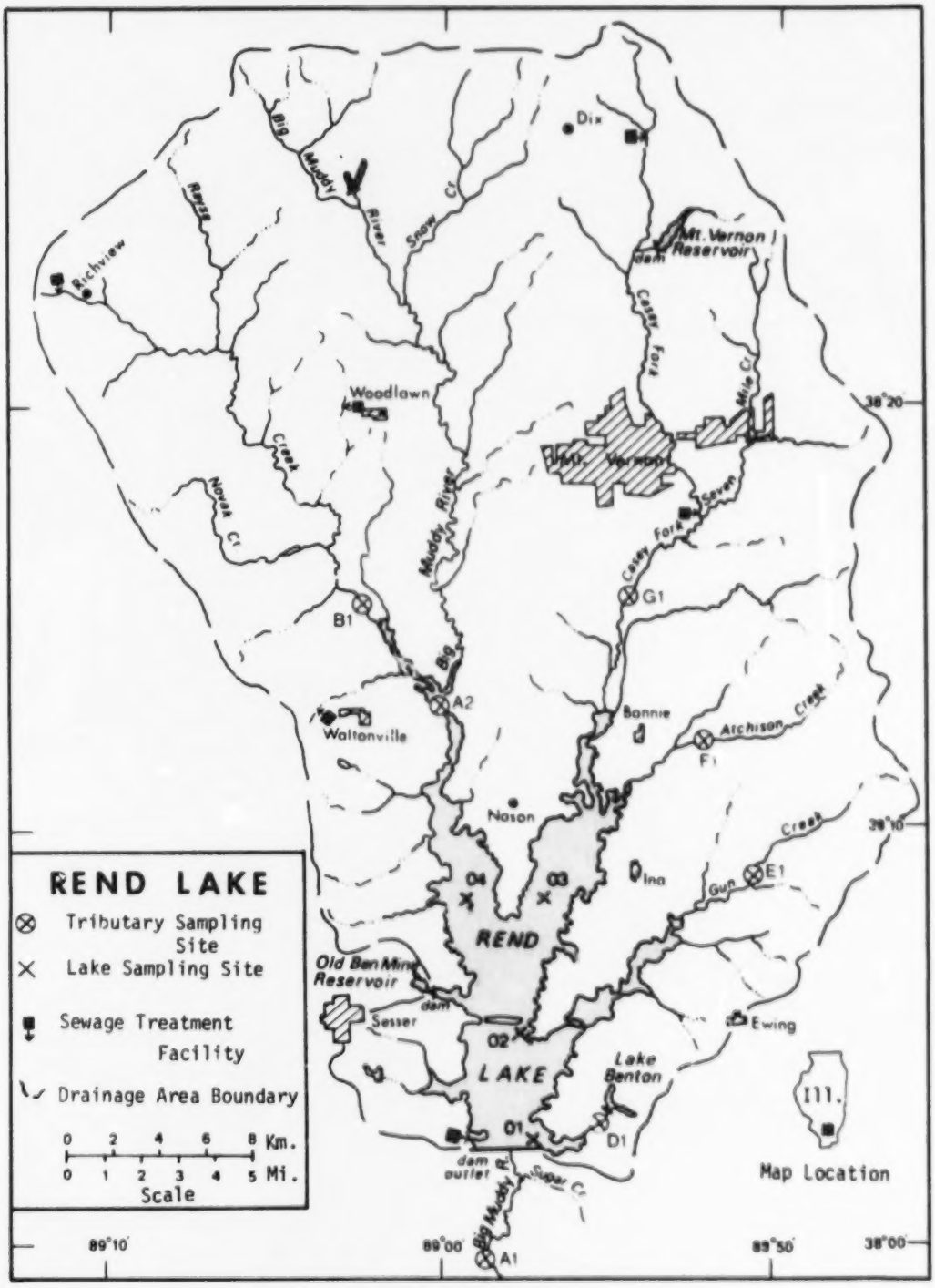
Major General Harold R. Patton, the Adjutant General of Illinois, and Project Officer Colonel Daniel L. Fane, who directed the volunteer efforts of the Illinois National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF ILLINOIS

LAKE NAME	COUNTY
Baldwin	Randolph
Bloomington	McLean
Carlyle	Bond, Clinton, Fayette
Cedar	Lake
Charleston	Coles
Coffeen	Montgomery
Crab Orchard	Jackson, Williamson
Decatur	Macon
DePue	Bureau
East Loon	Lake
Fox	Lake
Grass	Lake
Highland Silver	Madison
Holiday	LaSalle
Horseshoe	Madison
Long	Lake
Lou Yaeger	Montgomery
Marie	Lake
Old Ben Mine	Franklin
Pistakee	Lake, McHenry
Raccoon	Marion
Rend	Franklin, Jefferson
Sangchris	Christian
Shelbyville	Moultrie, Shelby
Slocum	Lake
Springfield	Sangamon
Storey	Knox
Vandalia	Fayette
Vermilion	Vermilion
Wee Ma Tuk	Fulton
Wonder	McHenry


REND LAKE
Tributary Sampling Site
Lake Sampling Site
Sewage Treatment Facility
Drainage Area Boundary
0 2 4 6 8 Km.
0 1 2 3 4 5 Mi.
Scale
Dix
Richview
Big Muddy River
Snow Ck
Mt. Vernon Reservoir
Dam
Casey Fork
Mile Ck
Woodlawn
Muddy River
Seven
Casey Fork
Nowak Ck
G1
B1
Big
A2
Waltonville
Bonnie
Atchison Creek
F1
Nason
Creek
38°10'
Ina
Gun
E1
REND
LAKE
Old Ben Mine Reservoir
dam
Sesser
Ewing
Lake Benton
D1
dam outlet
Sugar Ck
Big Muddy R.
Map Location
Ill.
89°10'
89°00'
89°50'
38°00'
38°20'

REND LAKE

STORET NO. 1735

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate that Rend Lake is eutrophic. It ranked fourth in overall trophic quality when the 31 Illinois lakes sampled in 1973 were compared using a combination of six parameters*. Seven lakes had less median total phosphorus, two had less and one had the same median dissolved phosphorus, six had less median inorganic nitrogen, 15 had less mean chlorophyll a, and nine had greater mean Secchi disc transparency. Depression of dissolved oxygen with depth occurred at sampling station 1 in August, 1973.

Survey limnologists reported emergent vegetation in the shallows along the shorelines.

B. Rate-Limiting Nutrient:

The algal assay results indicate that Rend Lake was phosphorus limited at the time the assay sample was collected (05/08/73). The lake data indicate phosphorus limitation at the other sampling times as well.

C. Nutrient Controllability:

1. Point sources--The phosphorus contribution of known point sources amounted to 20.3% of the total input to Rend

* See Appendix A.

Lake during the sampling year. However, the non-point source exports of the Big Muddy River and, particularly, Casey Fork were substantially higher than the other streams in the drainage basin (see page 14). It is likely that other point sources contributed significantly to the phosphorus loads, or the contributions from known point sources were underestimated. The known point sources contributing to the overall phosphorus load include Mt. Vernon (19.9%) and Dix (0.3%). Four additional sewage treatment facilities collectively contributed 0.2% of the total load reaching Rend Lake.

The present phosphorus loading rate of 0.97 $g/m^2/yr$ is over 2.5 times that proposed by Vollenweider (Vollenweider and Dillon, 1974) as a eutrophic rate (see page 14). A 100% reduction of the phosphorus from the known point sources would reduce the overall loading rate to about twice the eutrophic rate; however, because the lake is phosphorus limited, all phosphorus inputs should be minimized to the greatest practicable extent to slow the eutrophication of Rend Lake.

2. Non-point sources--Nearly 80% of the total annual phosphorus input to Rend Lake can be attributed to non-point sources. After accounting for the known point sources, the Big Muddy River contributed 32.3% and Casey Fork, 31.8%. The three remaining sampled tributaries collectively contributed 2.4% of the total.

The mean annual phosphorus contribution from ungaged tributaries was estimated to have been 11.3% of the total load. As discussed above, part of the mean annual non-point phosphorus exports of the Big Muddy River (45 kg/km^2) and Casey Fork (99 kg/km^2) probably should be attributed to additional point sources in the metropolitan areas rather than to non-point sources.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS†

A. Lake Morphometry††:

1. Surface area: 76.49 kilometers^2.
2. Mean depth: 4.7 meters.
3. Maximum depth: >6.6 meters.
4. Volume: 362.646 x 10^6 m^3.
5. Mean hydraulic retention time: 1.25 years.

B. Tributary and Outlet:
(See Appendix C for flow data)

1. Tributaries -

Name	Drainage area (km^2)*	Mean flow (m^3/sec)*
Big Muddy River	530.9	3.5
Marcum Branch Creek	7.7	<0.1
Gun Creek	35.5	0.2
Atchison Creek	31.3	0.2
Casey Fork Creek	240.1	1.5
Minor tributaries & immediate drainage -	378.2	3.8
Totals	1,223.7	9.2

2. Outlet -

Big Muddy River	1,300.2**	9.2

C. Precipitation***:

1. Year of sampling: 111.3 centimeters.
2. Mean annual: 106.3 centimeters.

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† Table of metric conversions--Appendix B.
†† Forneris, 1973.
* For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973-1976".
** Includes area of lake.
*** See Working Paper No. 175.

III. LAKE WATER QUALITY SUMMARY

Rend Lake was sampled three times during the open-water season of 1973 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from four stations on the lake and from a number of depths at each station (see map, page v). During each visit, a single depth-integrated (4.6 m or near bottom to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the first visit, a single 18.9-liter depth-integrated sample was composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analysis. The maximum depths sampled were 4.6 meters at station 1, 5.5 meters at station 2, and 3.0 meters at stations 3 and 4.

The lake sampling results are presented in full in Appendix D and are summarized in the following table.

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR WEND LAKE
STORET CODE 1735

PARAMETER	1ST SAMPLING (5/ 8/73) 4 SITES RANGE	MEAN	MEDIAN	2ND SAMPLING (8/ 8/73) 4 SITES RANGE	MEAN	MEDIAN	3RD SAMPLING (10/19/73) 4 SITES RANGE	MEAN	MEDIAN
TEMP (C)	17.2 - 18.1	17.7	17.8	27.3 - 29.1	28.3	28.3	17.6 - 18.7	18.2	18.2
DISS OXY (MG/L)	7.5 - 8.9	8.3	8.4	2.3 - 7.2	5.6	6.2	8.2 - 8.6	8.4	8.4
CNDCTVY (MCROMO)	280. - 330.	300.	293.	290. - 348.	334.	345.	278. - 287.	281.	280.
PH (STAND UNITS)	7.7 - 8.1	8.0	8.0	7.0 - 7.9	7.5	7.5	7.4 - 7.9	7.6	7.7
TOT ALK (MG/L)	37. - 43.	40.	39.	68. - 80.	72.	71.	73. - 80.	75.	74.
TOT P (MG/L)	0.050 - 0.103	0.080	0.086	0.028 - 0.099	0.063	0.064	0.047 - 0.082	0.065	0.066
ORTHO P (MG/L)	0.003 - 0.012	0.006	0.006	0.011 - 0.057	0.020	0.016	0.010 - 0.035	0.018	0.016
NO2+NO3 (MG/L)	0.040 - 0.100	0.062	0.060	0.110 - 0.280	0.171	0.150	0.140 - 0.330	0.254	0.295
AMMONIA (MG/L)	0.060 - 0.100	0.087	0.090	0.080 - 0.170	0.107	0.100	0.040 - 0.070	0.049	0.050
KJEL N (MG/L)	0.500 - 1.000	0.708	0.700	1.200 - 1.800	1.427	1.400	0.800 - 1.500	1.020	1.000
INORG N (MG/L)	0.100 - 0.190	0.150	0.155	0.200 - 0.450	0.278	0.250	0.190 - 0.380	0.303	0.340
TOTAL N (MG/L)	0.550 - 1.060	0.771	0.760	1.430 - 1.920	1.598	1.520	1.040 - 1.830	1.274	1.245
CHLRPYL A (UG/L)	14.3 - 35.2	25.6	26.4	7.7 - 51.4	29.4	29.3	10.3 - 21.7	15.6	15.2
SECCHI (METERS)	0.5 - 1.0	0.7	0.7	0.8 - 1.1	0.9	0.8	0.5 - 0.8	0.6	0.5

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal units per ml
05/08/73	1. Melosira sp.	6,826
	2. Cyclotella sp	1,365
	3. Cryptomonas sp.	928
	4. Flagellates	928
	5. Raphidiopsis sp.	874
	Other genera	5,407
	Total	16,328
08/08/73	1. Carteria sp.	1,428
	2. Microcystis sp.	1,217
	3. Chlamydomonas sp.	1,124
	4. Cyclotella sp.	936
	5. Flagellates	726
	Other genera	2,949
	Total	8,380
10/19/73	1. Flagellates	2,230
	2. Microcystis sp.	1,493
	3. Dactylococcopsis sp.	1,247
	4. Kirchneriella (?) sp.	661
	5. Scenedesmus sp.	639
	Other genera	2,263
	Total	8,533

2. Chlorophyll *a* -

Sampling Date	Station Number	Chlorophyll *a* (µg/l)
05/08/73	01	14.3
	02	35.2
	03	25.6
	04	27.2
08/08/73	01	7.7
	02	33.7
	03	51.4
	04	24.9
10/19/73	01	11.3
	02	10.3
	03	19.1
	04	21.7

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.005	0.080	0.1
0.050 P	0.055	0.080	3.6
0.050 P + 1.0 N	0.055	1.080	20.8
1.0 N	0.005	1.080	0.1

2. Discussion -

The control yield of the assay alga, *Selenastrum capricornutum*, indicates that the potential primary productivity of Rend Lake was low at the time the sample was collected (05/08/73). The significant increase in yield with the addition of phosphorus but the lack of yield response when

only nitrogen was added indicates the lake was phosphorus limited at that time.

The lake data further indicate phosphorus limitation. At all sampling times, the mean inorganic nitrogen/ortho-phosphorus ratios were 14/1 or greater, and phosphorus limitation would be expected.

IV. NUTRIENT LOADINGS
(See Appendix E for data)

For the determination of nutrient loadings, the Illinois National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v), except for the high runoff months of February and March when two samples were collected. Sampling was begun in June, 1973, and was completed in May, 1974.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Illinois District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*. Nutrient loads shown are those measured minus point-source loads, if any.

Nutrient loads for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the means of the nutrient exports, in $kg/km^2/year$, at stations D-1, E-1, and F-1 and multiplying the means by the ZZ area in km^2.

The operators of the Mt. Vernon and Corps of Engineers Rend Lake Administration Area wastewater treatment plants provided monthly effluent samples and corresponding flow data. The communities of Dix, Woodlawn, Waltonville, and Richview did not participate in the

* See Working Paper No. 175.

sampling program, and nutrient loads were estimated at 1.134 kg P and 3.401 kg N/capita/year.

A. Waste Sources:

1. Known municipal†-

Name	Pop. Served	Treatment	Mean Flow (m^3/d)	Receiving Water
Mt. Vernon	20,000	trickling filter	6,784.6	Casey Fork
C. of E. Adm. Area	11	ext. aer.	4.2*	Rend Lake
Woodlawn Schools	52**	Imhoff	19.7*	Rayse Creek
Waltonville Schools	30**	Imhoff	11.4*	Big Muddy River
Richview School	22**	Imhoff	8.3*	Rayse Creek
Dix	167***	lagoon	63.2*	Casey Fork

2. Known industrial - None

† Anonymous, 1972; and treatment plant questionnaires.
* Flow estimated at 0.3785 m^3/capita/day.
** Population equivalent = 37.5% of students in attendance (0.5 day x 0.75 yr).
*** 1970 Census.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/ yr	% of total
a. Tributaries (non-point load) -		
Big Muddy River	24,030	32.3
Marcum Branch Creek	125	0.2
Gun Creek	945	1.3
Atchison Creek	750	1.0
Casey Fork	23,725	31.8
b. Minor tributaries & immediate drainage (non-point load) -	8,445	11.3
c. Known municipal STP's -		
Mt. Vernon	14,820	19.9
C. E. Adm. Area	<5	<0.1
Woodlawn Schools	60	0.1
Waltonville Schools	35	<0.1
Richview School	25	<0.1
Dix	190	0.3
d. Septic tanks - Unknown	-	-
e. Known industrial - None	-	-
f. Direct precipitation* -	1,340	1.8
Total	74,490	100.0

2. Outputs -

Lake outlet - Big Muddy River 37,545

3. Net annual P accumulation - 36,945 kg.

* See Working Paper No. 175.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/ yr	% of total
a. Tributaries (non-point load) -		
Big Muddy River	310,785	41.1
Marcum Branch Creek	2,760	0.4
Gun Creek	15,770	2.1
Atchison Creek	14,970	2.0
Casey Fork	143,275	19.0
b. Minor tributaries & immediate drainage (non-point load) -	161,365	21.4
c. Known municipal STP's -		
Mt. Vernon	22,910	3.0
C. E. Adm. Area	15	<0.1
Woodlawn Schools	175	<0.1
Waltonville Schools	100	<0.1
Richview School	75	<0.1
Dix	570	0.1
d. Septic tanks - Unknown	-	-
e. Known industrial - None	-	-
f. Direct precipitation* -	82,580	10.9
Total	755,350	100.0

2. Outputs -

Lake outlet - Big Muddy River 433,690

3. Net annual N accumulation - 321,660 kg.

* See Working Paper No. 175.

D. Mean Annual Non-point Nutrient Export by Subdrainage Area:

Tributary	kg P/km²/yr	kg N/km²/yr
Big Muddy River	45	585
Marcum Branch Creek	16	358
Gun Creek	27	444
Atchison Creek	24	478
Casey Fork	99*	597

E. Yearly Loading Rates:

In the following table, the existing phosphorus loading rates are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" rate is the rate at which the receiving water would become eutrophic or remain eutrophic; his "permissible" rate is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic rate would be considered one between "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

	Total Phosphorus		Total Nitrogen	
	Total	Accumulated	Total	Accumulated
grams/m²/yr	0.97	0.48	9.9	4.2

Vollenweider loading rates for phosphorus (g/m²/yr) based on mean depth and mean hydraulic retention time of Rend Lake:

"Dangerous" (eutrophic rate)	0.38
"Permissible" (oligotrophic rate)	0.19

* High export value probably reflects point-source input.

V. LITERATURE REVIEWED

Anonymous, 1972. Wastewater treatment works data book. IL Env. Prot. Agency, Springfield.

Forneris, John J., 1973. Personal communication (lake morphometry). IL Env. Prot. Agency, Springfield.

Vollenweider, R. A., and P. J. Dillon, 1974. The application of the phosphorus loading concept to eutrophication research. Natl. Res. Council of Canada Publ. No. 13690, Canada Centre for Inland Waters, Burlington, Ontario.

VI. APPENDICES

APPENDIX A

LAKE RANKINGS

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	SUB-MEAN SEC	MEAN CHLORA	ISO-MIN OXY	MEDIAN DISS ORTHO P
1703	LAKE BLOOMINGTON	0.050	5.730	464.667	26.200	14.000	0.020
1706	LAKE CARLYLE	0.084	1.270	477.889	17.367	11.000	0.032
1708	LAKE CHARLESTON	0.160	4.680	490.667	12.000	8.400	0.065
1711	COFFEEN LAKE	0.032	0.260	456.222	7.700	14.900	0.012
1712	CRAB ORCHARD LAKE	0.062	0.200	482.222	59.867	13.600	0.013
1714	LAKE DECATUR	0.124	3.750	474.571	43.000	14.500	0.062
1725	LONG LAKE	0.704	1.140	482.667	49.333	8.800	0.398
1726	LAKE LOU YAEGER	0.186	1.600	489.583	10.662	11.400	0.076
1727	LAKE MARIE	0.098	0.370	467.667	34.533	14.700	0.057
1733	PISTAKEE LAKE	0.203	0.370	485.667	75.867	7.000	0.062
1735	REND LAKE	0.071	0.210	471.500	23.533	12.700	0.012
1739	LAKE SHELBYVILLE	0.062	3.290	481.333	17.161	14.800	0.014
1740	SILVER LAKE (HIGHLAND)	0.226	0.970	489.500	5.822	14.800	0.057
1742	LAKE SPRINGFIELD	0.104	3.265	483.385	13.013	10.400	0.059
1748	VERMILION LAKE	0.109	4.695	481.500	31.150	14.200	0.050
1750	WONDER LAKE	0.426	0.840	486.000	98.533	7.800	0.132
1751	LAKE STORY	0.072	2.510	459.333	17.250	14.800	0.021
1752	DEPUE LAKE	0.438	4.050	490.000	58.833	7.600	0.276
1753	LAKE SANGCHRIS	0.050	1.970	475.417	19.292	14.500	0.009
1754	LAKE HOLIDAY	0.167	3.135	485.167	51.217	7.200	0.046
1755	FOX LAKE	0.214	0.375	486.167	63.850	8.800	0.083
1756	GRASS LAKE	0.301	0.820	481.000	83.500	5.900	0.093
1757	EAST LOON LAKE	0.076	0.120	450.000	22.300	14.900	0.018
1758	SLOCUM LAKE	0.865	0.200	487.333	221.100	5.800	0.362
1759	CEDAR LAKE	0.029	0.170	400.333	5.767	12.800	0.013
1761	LAKE HEMATUR	0.069	1.770	466.333	7.967	14.500	0.031
1762	RACCOON LAKE	0.104	0.310	484.333	19.217	13.800	0.020
1763	BALDWIN LAKE	0.044	0.140	461.167	11.333	13.200	0.007

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P
1764	LAKE VANDALIA	0.116	0.480	478.111	11.276	14.800	0.023
1765	OLD BEN MINE RESERVOIR	0.930	0.205	478.333	31.433	11.200	0.575
1766	HORSESHOE LAKE	0.127	0.705	482.833	182.250	6.800	0.018

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P	INDEX NU
1703	LAKE BLOOMINGTON	88 (26)	0 (0)	80 (24)	47 (14)	13 (2)	68 (20)	296
1706	LAKE CARLYLE	63 (19)	40 (12)	63 (19)	63 (19)	63 (19)	53 (16)	345
1708	LAKE CHARLESTON	37 (11)	7 (2)	0 (0)	77 (23)	77 (23)	27 (8)	225
1711	COFFEEN LAKE	97 (29)	77 (23)	93 (28)	93 (28)	2 (0)	92 (27)	454
1712	CRAB ORCHARD LAKE	67 (20)	90 (27)	43 (13)	20 (6)	42 (12)	85 (25)	347
1714	LAKE DECATUR	40 (12)	13 (4)	53 (16)	33 (10)	30 (8)	32 (9)	201
1725	LONG LAKE	7 (2)	43 (13)	40 (12)	30 (9)	72 (21)	3 (1)	195
1726	LAKE LOU YAEGER	30 (9)	37 (11)	7 (2)	87 (26)	57 (17)	23 (7)	241
1727	LAKE MARIE	60 (18)	68 (20)	73 (22)	37 (11)	23 (7)	42 (12)	303
1733	PISTAKEE LAKE	27 (8)	68 (20)	23 (7)	13 (4)	90 (27)	32 (9)	253
1735	REND LAKE	77 (23)	80 (24)	70 (21)	50 (15)	53 (16)	92 (27)	422
1739	LAKE SHELBYVILLE	83 (25)	17 (5)	83 (25)	70 (21)	13 (2)	73 (22)	339
1740	SILVER LAKE (HIGHLAND)	20 (6)	47 (14)	10 (3)	97 (29)	13 (2)	42 (12)	229
1742	LAKE SPRINGFIELD	53 (16)	20 (6)	33 (10)	73 (22)	67 (20)	37 (11)	283
1748	VERMILION LAKE	50 (15)	3 (1)	47 (14)	43 (13)	37 (11)	47 (14)	227
1750	WONDER LAKE	13 (4)	50 (15)	20 (6)	7 (2)	80 (24)	13 (4)	183
1751	LAKE STORY	73 (22)	27 (8)	90 (27)	67 (20)	13 (2)	63 (19)	333
1752	DEPUE LAKE	10 (3)	10 (3)	3 (1)	23 (7)	83 (25)	10 (3)	139
1753	LAKE SANGCHRIS	88 (26)	30 (9)	67 (20)	57 (17)	30 (8)	97 (29)	369
1754	LAKE HOLIDAY	33 (10)	23 (7)	27 (8)	27 (8)	87 (26)	50 (15)	247
1755	FOX LAKE	23 (7)	63 (19)	17 (5)	17 (5)	72 (21)	20 (6)	212
1756	GRASS LAKE	17 (5)	53 (16)	50 (15)	10 (3)	97 (29)	17 (5)	244
1757	EAST LOON LAKE	70 (21)	100 (30)	97 (29)	53 (16)	2 (0)	77 (23)	399
1758	SLOCUM LAKE	3 (1)	87 (26)	13 (4)	0 (0)	100 (30)	7 (2)	210
1759	CEDAR LAKE	100 (30)	93 (28)	100 (30)	100 (30)	50 (15)	85 (25)	528
1761	LAKE WEMATUK	80 (24)	33 (10)	77 (23)	90 (27)	30 (8)	57 (17)	367
1762	RACCOON LAKE	57 (17)	73 (22)	30 (9)	60 (18)	42 (12)	68 (20)	330
1763	BALDWIN LAKE	93 (28)	97 (29)	67 (26)	80 (24)	47 (14)	100 (30)	504

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P	INDEX NO
1764	LAKE VANDALIA	47 (14)	60 (18)	60 (18)	83 (25)	13 (2)	60 (18)	323
1765	OLD BEN MINE RESERVOIR	0 (0)	83 (25)	57 (17)	40 (12)	60 (18)	0 (0)	240
1766	HORSESHOE LAKE	43 (13)	57 (17)	37 (11)	3 (1)	93 (28)	80 (24)	313

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	1759	CEDAR LAKE	528
2	1763	BALDWIN LAKE	504
3	1711	COFFEEN LAKE	454
4	1735	RENO LAKE	422
5	1757	EAST LOON LAKE	399
6	1753	LAKE SANGCHRIS	369
7	1761	LAKE WEMATUK	367
8	1712	CRAB ORCHARD LAKE	347
9	1706	LAKE CARLYLE	345
10	1739	LAKE SHELBYVILLE	339
11	1751	LAKE STORY	333
12	1762	RACCOON LAKE	330
13	1764	LAKE VANDALIA	323
14	1766	HORSESHOE LAKE	313
15	1727	LAKE MARIE	303
16	1703	LAKE BLOOMINGTON	296
17	1742	LAKE SPRINGFIELD	283
18	1733	PISTAKEE LAKE	253
19	1754	LAKE HOLIDAY	247
20	1752	GRASS LAKE	244
21	1726	LAKE LOU YAEGER	241
22	1765	OLD BEN MINE RESERVOIR	240
23	1740	SILVER LAKE (HIGHLAND)	229
24	1748	VERMILION LAKE	227
25	1708	LAKE CHARLESTON	225
26	1755	FOX LAKE	212
27	1758	SLOCUM LAKE	210
28	1714	LAKE DECATUR	201

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
29	1725	LONG LAKE	195
30	1750	WONDER LAKE	183
31	1752	DEPUE LAKE	139

APPENDIX B

CONVERSIONS FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX C

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR ILLINOIS 10/23/75

LAKE CODE 1735 REND LAKE

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 1300.2

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
1735A1	1300.2	9.63	12.71	16.48	17.53	18.72	10.02	6.46	3.45	2.62	3.31	4.67	5.58	9.24
1735A2	530.9	3.62	5.13	6.54	6.77	5.32	4.36	2.72	1.43	1.06	1.22	1.70	1.98	3.47
1735B1	227.9	1.51	2.21	2.78	2.86	2.25	1.87	1.14	0.60	0.43	0.48	0.69	0.81	1.46
1735D1	7.7	0.05	0.08	0.09	0.09	0.07	0.06	0.04	0.02	0.01	0.01	0.02	0.02	0.05
1735E1	35.5	0.22	0.35	0.42	0.43	0.34	0.29	0.17	0.09	0.06	0.06	0.10	0.11	0.22
1735F1	31.3	0.19	0.31	0.37	0.38	0.30	0.26	0.15	0.08	0.05	0.05	0.08	0.10	0.19
1735G1	240.1	1.59	2.33	2.92	3.03	2.38	1.97	1.21	0.63	0.45	0.51	0.73	0.86	1.54
1735ZZ	454.6	3.96	4.54	6.14	6.82	10.31	3.08	2.17	1.21	0.99	1.46	2.04	2.50	3.77

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 1300.2
SUM OF SUB-DRAINAGE AREAS = 1528.2

TOTAL FLOW IN = 128.82
TOTAL FLOW OUT = 111.18

NOTE *** TRIB B1 INCLUDED IN A2

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
1735A1	6	73	23.33	2	20.25				
	7	73	25.71	8	24.78				
	8	73	9.15	5	13.31				
	9	73	0.91	8	0.91				
	10	73	0.91	9	0.91				
	11	73	1.19	4	0.91				
	12	73	6.37	2	3.71				
	1	74	21.89	19	18.89				
	2	74	30.58	17	29.45	23	28.88		
	3	74	31.43	10	31.71	16	33.13		
	4	74	30.58	3	29.45				
	5	74	24.01	4	31.15				
1735A2	6	73	6.94	2	0.31				
	7	73	0.19	8	0.24				
	8	73	0.13	5	0.01				
	9	73	0.17	8	0.01				
	10	73	0.08	9	0.01				
	11	73	3.11	4	0.27				
	12	73	5.15	2	0.34				
	1	74	6.43	19	12.77				
	2	74	3.91	17	0.42	23	21.12		
	3	74	4.90	10	17.98	16	22.88		
	4	74	6.68	3	2.21				
	5	74	2.46	4	1.67				

TRIBUTARY FLOW INFORMATION FOR ILLINOIS 10/23/75

LAKE CODE 1735 REND LAKE

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
1735B1	6	73	2.97	2	0.13				
	7	73	0.08	8	0.10				
	8	73	0.05	5	0.01				
	9	73	0.07	8	0.01				
	10	73	0.03	9	0.0				
	11	73	1.27	4	0.11				
	12	73	2.12	2	0.14				
	1	74	2.69	19	5.32				
	2	74	1.67	17	0.18	23	9.12		
	3	74	2.07	10	7.65	16	9.71		
	4	74	2.83	3	0.93				
	5	74	1.05	4	0.71				
1735D1	6	73	0.10	2	0.01				
	7	73	0.00	8	0.00				
	8	73	0.0	5	0.0				
	10	73	0.0	9	0.0				
	11	73	0.03	4	0.00				
	12	73	0.06	2	0.00				
	1	74	0.08	19	0.16				
	2	74	0.06	17	0.01	23	0.31		
	3	74	0.07	10	0.25	16	0.31		
	4	74	0.09	3	0.03				
	5	74	0.03	4	0.02				
1735E1	6	73	0.45	2	0.02				
	7	73	0.01	8	0.01				
	8	73	0.01	5	0.0				
	9	73	0.01	8	0.0				
	10	73	0.01	9	0.0				
	11	73	0.17	4	0.01				
	12	73	0.28	2	0.02				
	1	74	0.40	19	0.76				
	2	74	0.27	17	0.03	23	1.44		
	3	74	0.31	10	1.16	16	1.47		
	4	74	0.42	3	0.14				
	5	74	0.16	4	0.10				
1735F1	6	73	0.40	2	0.02				
	7	73	0.01	8	0.01				
	8	73	0.01	5	0.0				
	9	73	0.01	8	0.0				
	10	73	0.00	9	0.0				
	11	73	0.15	4	0.01				
	12	73	0.26	2	0.02				
	1	74	0.34	19	0.68				
	2	74	0.23	17	0.03	23	1.25		
	3	74	0.28	10	1.02	16	1.30		
	4	74	0.37	3	0.12				
	5	74	0.14	4	0.09				

TRIBUTARY FLOW INFORMATION FOR ILLINOIS 10/23/75

LAKE CODE 1735 REND LAKE

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
1735G1	6	73	3.14	2	0.14				
	7	73	0.08	8	0.11				
	8	73	0.06	5	0.01				
	9	73	0.07	8	0.01				
	10	73	0.04	9	0.01				
	11	73	1.33	4	0.12				
	12	73	2.24	2	0.15				
	1	74	2.83	19	5.61				
	2	74	1.78	17	0.19	23	9.60		
	3	74	2.18	10	8.01	16	10.22		
	4	74	3.00	3	0.99				
	5	74	1.10	4	0.74				
1735ZZ	6	73	5.80	2	0.25				
	7	73	0.16	8	0.20				
	8	73	0.11	5	0.01				
	9	73	0.14	8	0.01				
	10	73	0.07	9	0.01				
	11	73	2.58	4	0.23				
	12	73	4.28	2	0.28				
	1	74	5.35	19	10.68				
	2	74	3.11	17	0.34	23	16.88		
	3	74	4.16	10	15.29	16	19.31		
	4	74	6.71	3	1.90				
	5	74	2.12	4	1.44				

APPENDIX D

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 75/10/23

173501
38 02 35.0 088 57 05.0
MEND LAKE
17055 ILLINOIS

11EPALES
3

2111202
0019 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/05/08	15 00	0000	17.2		40	330	8.00	43	0.100	0.700	0.080	0.003
	15 00	0008	17.2	8.8		330	8.10	43	0.090	0.600	0.100	0.004
	15 00	0015	17.2	8.9		330	8.10	42	0.090	0.700	0.090	0.005
73/08/08	14 10	0000	28.1		42	340	7.50	69	0.100	1.400	0.250	0.022
	14 10	0005	28.2	6.2		342	7.50	68	0.100	1.200	0.250	0.018
	14 10	0015	27.3	2.3		335	7.00	70	0.170	1.200	0.280	0.023
73/10/19	11 45	0000	18.7		33	280	7.80	73	0.040	1.000	0.330	0.017
	11 45	0005	18.7	8.6		279	7.80	74	0.040	0.800	0.320	0.019
	11 45	0011	18.6	8.4		278	7.70	74	0.050	1.500	0.330	0.013

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/05/08	15 00	0000	0.052	14.3
	15 00	0008	0.050	
	15 00	0015	0.050	
73/08/08	14 10	0000	0.028	7.7
	14 10	0005	0.035	
	14 10	0015	0.037	
73/10/19	11 45	0000	0.049	11.3
	11 45	0005	0.048	
	11 45	0011	0.047	

STORET RETRIEVAL DATE 75/10/23

173502
38 05 10.0 088 57 35.0
KEND LAKE
17055 ILLINOIS

11EPALES
3

2111202
0022 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/05/08	15 30	0000	17.6		20	315	8.10	41	0.060	0.700	0.050	0.004
	15 30	0005	17.6	8.8		310	8.10	42	0.060	0.600	0.040	0.007
	15 30	0018	17.6	8.8		305	8.00	39	0.070	0.500	0.050	0.003
73/08/08	13 45	0000	29.1		32	348	7.90	69	0.090	1.700	0.150	0.011
	13 45	0005	28.9	7.2		346	7.70	69	0.090	1.300	0.160	0.020
	13 45	0013	28.3	6.2		345	7.70	71	0.130	1.500	0.190	0.057
73/10/19	11 30	0000	18.3		18	280	7.90	74	0.050	1.000	0.310	0.035
	11 30	0005	18.3	8.4		278	7.70	73	0.050	0.900	0.300	0.020
	11 30	0012	18.2	8.4		278	7.70	74	0.040	1.000	0.290	0.030

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/05/08	15 30	0000	0.071	35.2
	15 30	0005	0.082	
	15 30	0018	0.076	
73/08/08	13 45	0000	0.041	33.7
	13 45	0005	0.054	
	13 45	0013	0.099	
73/10/19	11 30	0000	0.062	10.3
	11 30	0005	0.058	
	11 30	0012	0.070	

STORET RETRIEVAL DATE 75/10/23

173503
38 08 20.0 088 56 55.0
REND LAKE
17081 ILLINOIS

11EPALES
3

2111202
0014 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/05/08	15 50	0000	18.0		24	280	7.70	39	0.100	0.800	0.050	0.012
	15 50	0004	18.0	8.0		280	8.00	39	0.090	0.700	0.050	0.007
	15 50	0010	18.0	8.0		280	8.00	37	0.100	0.700	0.060	0.011
73/08/08	12 25	0000	28.4		30	348	7.40	74	0.130	1.800	0.120	0.013
	12 25	0004	28.4	6.2		348	7.50	74	0.100	1.400	0.110	0.012
	12 25	0008	28.3	6.0		347	7.50	75	0.100	1.300	0.130	0.016
73/10/19	10 58	0000	18.2		19	284	7.40	73	0.070	1.100	0.190	0.014
	10 58	0005	18.2	8.6		284	7.40	74	0.050	1.000	0.180	0.011

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/05/08	15 50	0000	0.103	25.6
	15 50	0004	0.097	
	15 50	0010	0.092	
73/08/08	12 25	0000	0.064	51.4
	12 25	0004	0.070	
	12 25	0008	0.094	
73/10/19	10 58	0000	0.082	19.1
	10 58	0005	0.079	

STORET RETRIEVAL DATE 75/10/23

173504
38 08 12.0 088 59 15.0
REND LAKE
17081 ILLINOIS

11EPALES 2111202
3 0013 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 N02&N03 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/05/08	16 15	0000	18.0		30	280	7.90	38	0.100	1.000	0.060	0.008
	16 15	0004	18.1	7.5		280	7.80	37	0.100	0.700	0.060	0.007
	16 15	0010	18.0	7.6		280	7.80	39	0.090	0.800	0.060	0.005
73/08/08	12 55	0000	28.0		30	290J	7.30	78	0.080	1.400	0.120	0.011
	12 55	0005	27.9	5.4		290J	7.20	80	0.090	1.500	0.120	0.012
73/10/19	11 07	0000	17.6		24	285	7.50	80	0.050	0.900	0.140	0.015
	11 07	0005	17.6	8.2		287	7.50	78	0.050	1.000	0.150	0.010

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/05/08	16 15	0000	0.090	27.2
	16 15	0004	0.101	
	16 15	0010	0.101	
73/08/08	12 55	0000	0.085	24.9
	12 55	0005	0.090	
73/10/19	11 07	0000	0.081	21.7
	11 07	0005	0.077	

J VALUE KNOWN TO BE +/- ERROR

APPENDIX E

TRIBUTARY and WASTEWATER TREATMENT PLANT DATA

STORET RETRIEVAL DATE 75/10/23

1735A1
38 59 20.0 083 58 35.0
BIG MUDDY RIVER
17097 7.5 W FRANKFORT
O/REND LAKE
ST HWY 14 BRDG BELO DAM 2 MI W OF BENTON
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/06/02	11 40		0.120	1.600	0.168	0.032	0.120
73/07/08	09 55		0.336	1.900	0.126	0.029	0.105
73/08/05	09 05		0.210	2.600	0.300	0.029	0.095
73/09/08	14 35		0.440	1.260	0.105	0.098	0.240
73/10/09	17 55		0.680	0.920	0.056	0.220	0.330
73/11/04	09 30		0.560	0.750	0.058	0.200	0.300
73/12/02	13 35		0.260	1.000	0.084	0.060	0.125
74/01/19	15 10		0.276	0.600	0.028	0.016	0.130
74/02/17	10 20		0.252	0.100	0.037	0.010	0.020
74/02/23	09 10		0.300	1.300	0.260	0.010	0.060
74/03/10	14 00		0.290	1.500	0.070	0.010	0.075
74/03/16	14 15		0.312	0.800	0.045	0.015	0.080
74/04/03	14 30		0.240	1.300	0.075	0.015	0.035
74/05/04	15 10		0.084	0.700	0.065	0.020	0.070

STORET RETRIEVAL DATE 75/10/23

1735A2
38 12 50.0 089 00 15.0
BIG MUDDY RIVER
17 7.5 DUQUOIN
I/REND LAKE
HWY 148 BRDG 1 MI E OF WALTONVILLE
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/06/02	16	30	0.300	4.200	0.176	0.018	0.180
73/07/08	11	30	0.034	1.400	0.056	0.017	0.140
73/08/05	11	30	0.042	5.350	0.310	0.022	0.125
73/09/08	16	15	0.410	1.380	0.130	0.046	0.230
73/10/09	20	15	0.010K	3.200	0.090	0.015	0.120
73/11/04	10	55	0.660	1.150	0.075	0.126	0.315
73/12/02	15	00	0.510	1.400	0.116	0.072	0.270
74/01/19	15	00	1.090	2.800	0.056	0.040	0.780
74/02/17	11	30	0.300	0.150	0.030	0.010	0.030
74/02/23	10	20	0.650	1.400	0.080	0.025	0.125
74/03/10	15	50	0.490	2.650	0.085	0.045	0.475
74/03/16	15	30	0.504	2.400	0.110	0.045	0.480
74/04/03	15	25	0.232	1.100	0.070	0.025	0.115
74/05/04	15	00	0.144	0.900	0.070	0.025	0.135

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/10/23

173581
38 00 10.0 089 02 30.0
RAYSE CREEK
17 7.5 ASHLEY
T/REND LAKE
RD BRDG 3 MI N OF WALTONVILLE
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/06/02	16 55		0.670	3.300	0.176	0.028	0.200
73/07/08	11 15		0.147	2.400	0.080	0.018	0.080
73/08/05	11 15		0.032	3.600	0.092	0.021	0.120
73/09/08	16 30		0.130	0.900	0.105	0.024	0.100
73/11/04	10 45		0.490	2.100	0.460	0.110	0.330
73/12/02	15 10		0.704	1.600	0.056	0.104	0.350
74/01/19	15 15		2.640	1.000	0.048	0.052	0.260
74/02/17	11 20		0.368	0.400	0.030	0.005	0.025
74/02/23	10 35		0.552	1.400	0.100	0.020	0.090
74/03/10	16 10		0.860	2.000	0.085	0.045	0.360
74/03/16	15 40		0.570	2.500	0.140	0.055	0.370
74/04/03	15 35		0.370	1.200	0.100	0.030	0.150
74/05/04	16 15		0.140	1.000	0.090	0.025	0.140

STORET RETRIEVAL DATE 75/10/23

1735C1
38 01 30.0 088 56 58.0
SUGAR CREEK
17 15 INA
T/REND LAKE
RD BRDG 1 MI NW OF BENTON
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/06/02	12 20		9.000	5.100	1.850	6.100	7.000
73/07/08	09 30		11.600	2.800	1.400	10.400	10.500
73/08/05	09 20		5.000	4.900	1.600	10.500	11.000
73/09/08	14 50		10.500	3.550	1.790	11.300	11.500
73/10/09	18 10		9.300	5.400	2.450	13.600	13.800
73/11/04	09 45		9.200	4.900	2.520	8.600	10.500
73/12/02	13 50		4.400	2.400	0.980	2.940	3.400
74/01/19	15 00		1.500	2.400	0.755	0.735	1.500
74/02/17	10 10		1.600	8.200	3.900	5.900	9.700
74/02/23	09 00		0.830	5.500	2.100	4.000	5.200
74/03/10	13 50		1.900	3.300	0.650	0.820	1.000
74/03/16	14 00		1.760	3.300	0.850	0.850	1.050
74/04/03	14 15		1.800	4.800	1.140	1.050	1.720
74/05/04	15 00		5.200	1.700	0.375	2.100	2.800

STORET RETRIEVAL DATE 75/10/23

173501
38 02 55.0 088 55 15.0
MARCUM BRANCH CREEK
17 15 INA
T/REND LAKE
ST HWY 37 BRDG 3 MI N OF BENTON
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/06/02	14 20		0.160	3.400	0.210	0.034	0.110
73/07/08	10 10		1.200	3.000	0.210	0.038	0.170
73/11/04	09 55		0.056	1.350	0.224	0.116	0.170
73/12/02	14 00		0.192	0.800	0.048	0.048	0.110
74/01/19	15 30		0.264	0.800	0.128	0.026	0.105
74/02/17	10 30		0.080	0.900	0.045	0.030	0.070
74/02/23	09 45		0.112	1.700	0.052	0.015	0.015
74/03/10	14 30		0.112	0.600	0.045	0.010	0.040
74/03/16	14 30		0.096	1.100	0.045	0.010	0.025
74/04/03	14 40		0.096	2.400	0.160	0.020	0.060
74/05/04	15 25			0.500	0.030	0.035	0.075

STORET RETRIEVAL DATE 75/10/23

17356I
38 08 55.0 088 50 40.0
GUM CREEK
17 15 INA
T/REND LAKE
RD BRDG 3 MI E OF INA
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/06/02	14 45		0.450	2.700	0.252	0.035	0.150
73/07/08	10 30		0.072	1.600	0.250	0.031	0.110
73/08/05	10 30			2.400	0.540	0.030	0.145
73/09/08	15 20		0.056	3.100	0.450	0.042	0.180
73/10/09	19 00			1.800	0.040	0.012	0.120
73/11/04	10 10		0.060	0.950	0.076	0.028	0.130
73/12/02	14 15		0.820	1.000	0.120	0.048	0.160
74/01/19	14 00		2.100	1.000	0.064	0.048	0.165
74/02/17	10 40		0.264	1.100	0.045	0.010	0.050
74/02/23	11 00		0.470	1.300	0.125	0.020	0.105
74/03/10	14 40		0.890	2.700	0.105	0.040	0.270
74/03/16	14 55		0.880	1.800	0.210	0.045	0.195
74/04/03	14 50		0.192	0.800	0.070	0.025	0.100
74/05/04	15 35		0.290	0.900	0.100	0.032	0.155

STORET RETRIEVAL DATE 75/10/23

1735F1
38 12 00.0 088 52 05.0
ATCHISON CREEK
17 15 INA
T/REND LAKE
RD BRDG 2 MI E OF BONNIE
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/06/02	15 05		0.270	1.540	0.084	0.023	0.075
73/07/08	10 45		0.690	1.400	0.147	0.025	0.105
73/08/05	10 45		0.039	1.980	0.070	0.028	0.195
73/09/08	15 40		0.115	1.320	0.044	0.017	0.085
73/10/09	19 30		0.012	2.520	0.050	0.029	0.225
73/11/04	10 20		0.018	1.550	0.034	0.025	0.225
73/12/02	14 25		0.740	1.400	0.108	0.048	0.155
74/01/19	14 15		2.700	0.900	0.108	0.044	0.145
74/02/17	09 45		0.440	1.500	0.040	0.015	0.120
74/02/23	10 10		0.760	1.200	0.060	0.015	0.060
74/03/10	14 55		1.040	2.400	0.085	0.030	0.180
74/03/16	15 05		1.010	2.000	0.225	0.035	0.185
74/04/03	15 00		0.320	1.100	0.065	0.015	0.135
74/05/04	15 45		0.270	0.700	0.050	0.020	0.110

STORET RETRIEVAL DATE 75/10/23

173561
38 15 30.0 088 54 50.0
CASEY FORK
17 15 INA
T/RENO LAKE
RD BRDG .5 MI W OF HWY 37 JCT
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/06/02	15 30		1.440	1.640	0.280	0.960	1.200
73/07/08	11 45		1.660	4.250	0.290	0.910	1.050
73/08/05	12 00		1.200	4.800	0.810	3.100	3.800
73/09/08	15 55		1.000	2.400	0.930	0.920	1.450
73/10/09	20 55		0.100	1.600	0.280	0.115	0.240
73/11/04	11 45		1.920	2.900	1.080	1.700	2.200
73/12/02	14 35		0.704	1.500	0.208	0.224	0.475
74/01/14	14 30		1.010	2.500	0.112	0.056	0.850
74/02/17	11 05		0.352	1.700	0.050	0.040	0.130
74/02/23	11 00		0.620	1.200	0.345	0.240	0.500
74/03/10	15 25		0.480	1.700	0.095	0.070	0.230
74/03/16	15 15		0.470	1.200	0.125	0.070	0.220
74/04/03	15 15		0.280	1.900	0.080	0.040	0.175
74/05/04	15 55		0.520	0.900	0.035	0.035	0.200

STORET RETRIEVAL DATE 75/10/23

17350A IF17350A P020000
38 14 30.0 088 54 30.0
MT. VERNON S.T.P.
17097 7.5 MT. VERNON
T/HENO LAKE
CASEY FORK
11EPALES 2141204
0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
73/08/31	09 00								
CP(T)-				8.500	0.570	5.400	6.500	1.900	1.400
73/08/31	14 00								
73/09/28	08 00								
CP(T)-			2.500	9.850	1.200	9.900	10.000	1.600	1.400
73/09/28	15 00								
73/10/31	08 00								
CP(T)-			1.500	9.300	2.500	6.400	8.000	3.200	1.400
73/10/31	13 30								
73/11/30	08 00								
CP(T)-			4.500	5.600	0.300	2.900	3.900	2.200	1.700
73/11/30	14 00								
74/01/02	14 30		4.700	4.750	0.270	2.640	3.750	2.200	2.100
74/01/31	08 00								
CP(T)-			0.040	1.500	0.770	2.640	4.400	2.300	2.200
74/01/31	13 30								
74/02/28	07 30								
CP(T)-			3.360	5.600	0.600	3.400	4.400	2.300	2.100
74/02/28	13 30								
74/03/29	08 00								
CP(T)-			2.160	3.300	0.270	3.680	4.050	2.300	2.300
74/03/29	14 30								
74/05/02	08 00								
CP(T)-			3.520	3.400	1.000	4.100	5.400	2.500	2.200
74/05/02	14 00								
74/05/31	08 00								
CP(T)-			3.900	7.000	0.720	6.020	6.200	2.400	2.000
74/05/31	13 30								
74/06/28	08 30								
CP(T)-			3.600	6.000	0.310	2.900	3.300	1.500	1.800
74/06/28	14 00								
74/07/31	08 00								
CP(T)-			2.000	14.000	3.600	10.000	10.500	1.300	1.200
74/07/31	14 00								
74/08/30	07 00								
CP(T)-			0.150	11.000	0.650*		7.900	1.800	1.500
74/08/30	13 00								

* VALUE KNOWN TO BE LESS THAN INDICATED

STORET RETRIEVAL DATE 75/10/23

173521 EA173521 P000003
38 02 30.0 088 59 15.0
ADMINISTRATION AREA (BENTON)
17081 15 INA
D/REND LAKE
REND LAKE
11EPALES 21+1204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
73/07/24	11 00								
CP(T)-			26.000	0.100		3.700	4.600	0.0003	0.0003
73/07/24	16 00								
73/08/27	11 00								
CP(T)-			36.000	0.340	0.033	4.060	4.200	0.0003	0.0003
73/08/27	16 00								
73/09/28	11 00								
CP(T)-			53.000	0.100	0.050	4.581	4.600	0.0003	0.0003
73/09/28	16 00								
73/10/25	11 00								
CP(T)-			39.000	0.500K	0.075	2.400	2.800	0.0003	0.0003
73/10/25	16 00								
73/12/04	11 00								
CP(T)-			14.200	1.000K	0.048	1.400	1.400	0.0003	0.0003
73/12/04	16 00								
73/12/28	11 00								
CP(T)-			8.500	0.500K	0.150	0.945	0.947	0.0003	0.0003
73/12/28	16 00								
74/01/25	11 00								
CP(T)-			11.200	0.500K	0.120	0.840	0.910	0.0003	0.0003
74/01/25	16 00								
74/03/24	11 00								
CP(T)-			16.800	1.000K	0.078	0.8[illegible]	1.000	0.0003	0.0003
74/03/24	16 00								
74/04/26	11 00								
CP(T)-			22.000	1.500	0.130	2.000	2.300	0.0003	0.0003
74/04/26	16 00								
74/05/30	11 00								
CP(T)-			32.000	1.000K	0.100	4.100	4.500	0.0003	0.0003
74/05/30	16 00								
74/07/31	11 00								
CP(T)-			53.000	2.100	0.200	6.900	7.500	0.0003	0.0003
74/07/01	16 00								
74/07/31	11 00								
CP(T)-			65.000	4.400	2.700	9.000	9.600	0.0003	0.0003
74/07/31	16 00								

K value known to be
less than indicated

STORET RETRIEVAL DATE 75/10/23

173521 EA173521 P000003
38 02 30.0 088 59 15.0
ADMINISTRATION AREA (BENTON)
17081 15 INA
D/RENO LAKE
RENO LAKE
11EPALES 2141204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
74/08/28 CP(T)- 74/08/28	11 00 16 00		0.240	3.500	0.073	0.750	3.000	0.0003	0.0003

K VALUE KNOWN TO BE LESS THAN INDICATED